MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

BEM1034 – MATHEMATICS FOR ECONOMICS

(All sections / Groups)

5 OCTOBER 2022
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **FOUR (4)** printed pages with 4 questions only, excluding the cover page.

2. Attempt **ALL FOUR (4)** questions.

3. Write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. Mathematical formula is attached at the end of this question paper.

Question 1 (25 marks)

(a) Let $\xi=\{1,2,3,4,5,6,7,8,9,10\}$, $A=\{1,2,5,8,9\}$ and $B=\{3,5,6,7,8\}$. Show that $\overline{(A\cup B)}=\overline{A}\cap\overline{B}$.

[5 marks]

(b) Solve the following equation.

(i) $\log_5(2x+1)-\log_5(x-2)=1$.

[5 marks]

(ii) $4e^{3x-1.5}=360$.

[4 marks]

(c) The number of citizens aged 50-65 years is approximated by

$$P(t)=\frac{197.9}{1+3.274e^{-0.0361t}} \qquad (0\le t\le 25)$$

where $P(t)$ is measured in millions and t is measured in years, with $t=0$ corresponding to 2000. People belonging to this age group are the targets of insurance companies that want to sell them annuities. Compute the expected population of citizens aged 50-65 years in 2020?

[3 marks]

(d) A certain piece of machinery was purchased 3 years ago by Dwayne Johnson for \$800,000. Its present resale value is \$640,000. Assuming that the machine's resale value decreases exponentially, what will the value be 6 years from now?

[8 marks]

Continued...

Question 2 (25 marks)

(a) If $A=\begin{bmatrix}-3 & 1\\ 2 & 0\end{bmatrix}$ and $B=\begin{bmatrix}-1 & 2\\ 8 & 7\end{bmatrix}$, find X if $3X+A=B$.

[4 marks]

(b) The equilibrium condition for three related markets is given by

$$\begin{aligned}11P_1-P_2-P_3&=31\\ -P_1+6P_2-2P_3&=26\\ -P_1-2P_2+7P_3&=24\end{aligned}$$

Use Cramer's rule to solve for the equilibrium price for each market.

[21 marks]

Question 3 (25 marks)

(a) Use the rules of limits to find the limits for the following function.

(i) $\lim\limits_{x\to 3}\left[x^4(x+5)\right]$

[3 marks]

(ii) $\lim\limits_{x\to 4^+}\dfrac{3x-4}{x-4}$

[4 marks]

(b) Find the value(s) of x for which the function is discontinuous.

$$f(x)=\frac{3x}{2x^2-3x+1}$$

[3 marks]

(c) Find the total differential of the following function.

$$z=x^2\left(3y+y^2\right)^3;\quad \Delta x=0.02 \text{ and } \Delta y=0.01$$

[6 marks]

Continued...

(d) Use logarithmic differentiation to find the derivative of the following function.

$$y = e^{x}\left(x^{2}+4x\right)$$

[9 marks]

Question 4 (25 marks)

(a) Solve the following integral:

$$\int_{0}^{1} \frac{1}{\sqrt{2x+1}}\, dx.$$

[6 marks]

(b) The rate of net investment is given by $I(t) = 140t^{\frac{3}{4}}$, and the initial stock of capital at $K(0)$ is 150. Find the time path of capital $K(t)$.

[6 marks]

(c) State the order of the following differential equation.

$$\frac{d^{4}y}{dx^{4}} + \left(\frac{d^{3}y}{dt^{3}}\right)^{2} - y = 0$$

[2 marks]

(d) Find the integrating factor for the differential equation given below. Then, solve the differential equation.

$$2y' + 4y = 1.$$

[11 marks]

End of Question.

Subject Code: BEM1034
Subject Name: Mathematics for Economics

Summary of Formulas

1. **Input-Output Model**
   $(I-A)\,X=D$
   where A is the input-output matrix, D is the external or final demand and X is the production level.

2. **Total differential (change)**
   If $z=f(x,y)$, then the total change is $dz=f_x dx+f_y dy$

3. **Elasticity of demand**
   $$\varepsilon_d=-\frac{dq}{dp}\Big|_{(q,p)}\cdot\frac{p}{q}$$

4. **Consumers' Surplus (CS)**

   $$CS=\int_0^{\bar{q}} D(q)dq-\overline{pq}$$

   where $\bar{p}$ is the unit market price, $\bar{x}$ is the quantity sold and D is the demand function.

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